

WHAT IS CLAIMED IS:

1. A picture encoding apparatus comprising:
 - arithmetic encoding means for applying arithmetic encoding to an input picture to generate an encoded codestream;
 - splitting means for splitting said encoded codestream into a plurality of layers;
 - packet generating means for generating a plurality of packets from one layer to another;
 - error correction encoding means for applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and
 - embedding means for embedding an inspection symbol generated by said error correction encoding means in a packet or packets of a predetermined lower layer.
2. The picture encoding apparatus according to claim 1 wherein said predetermined one or more layers includes at least the uppermost layer.
3. The picture encoding apparatus according to claim 1 wherein said embedding means substitutes said inspection symbol for data of said packet or packets of said predetermined lower layer.
4. The picture encoding apparatus according to claim 3 wherein, if the data volume of said inspection symbol is larger than the data volume of the packets of

said predetermined lower layer, said embedding means embeds said inspection symbol across the packets of a plurality of lower layers including said predetermined lower layer.

5. The picture encoding apparatus according to claim 1 wherein said embedding means appends said inspection symbol to data of a packet or packets of said predetermined lower layer.

6. The picture encoding apparatus according to claim 5 wherein said embedding means changes the data length stated in a packet header of a packet or packets of said predetermined lower layer.

7. The picture encoding apparatus according to claim 1 wherein said error correction encoding means sets the subject entity of the error correction encoding depending on the error rate of a communication channel on which said encoded codestream is transmitted.

8. A picture encoding apparatus comprising:

arithmetic encoding means for applying arithmetic encoding to an input picture to generate an encoded codestream;

splitting means for splitting said encoded codestream into a plurality of layers;

packet generating means for generating a plurality of packets from one layer to another;

error correction encoding means for applying error correction encoding to

data of a header and/or a packet or packets of a predetermined one or more layers; and

embedding means for embedding an inspection symbol generated by said error correction encoding means in a main header or in a COM marker of a tile part header.

9. A picture encoding apparatus comprising:

filtering means for filtering an input picture to generate a plurality of sub-bands;

code block generating means for splitting each sub-band to generate a plurality of code blocks each being of a predetermined size;

bitplane generating means for generating a plurality of bitplanes from the most significant bit to the least significant bit, from one code block to another;

bit modeling means for executing bit modeling from one bitplane to another;

encoding pass generating means for generating an encoding pass from one bitplane to another;

arithmetic encoding means for executing arithmetic coding in the encoding pass generated by said encoding pass generating means to generate an encoded codestream;

splitting means for splitting said encoded codestream into a plurality of layers;

packet generating means for generating a plurality of packets from one layer

to another;

error correction encoding means for applying error correction encoding to data of a header and/or a packet or packets of predetermined one or more layers; and

embedding means for embedding an inspection symbol generated by said error correction encoding means in a portion of a predetermined code block or in a newly added encoding pass.

10. A picture encoding method comprising:

an arithmetic encoding step of applying arithmetic encoding to an input picture to generate an encoded codestream;

a splitting step of splitting said encoded codestream into a plurality of layers;

a packet generating step of generating a plurality of packets from one layer to another;

an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of predetermined one or more layers; and

an embedding step of embedding an inspection symbol generated by said error correction encoding step in the packets of a predetermined lower layer.

11. A picture encoding method comprising:

an arithmetic encoding step of applying arithmetic coding to an input picture to generate an encoded codestream;

a splitting step of splitting said encoded codestream into a plurality of layers;
a packet generating step of generating a plurality of packets from one layer to another;

an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and

an embedding step of embedding an inspection symbol generated by said error correction encoding step in a main header or in a COM marker of a tile part header.

12. A picture encoding method comprising:

a filtering step of filtering an input picture to generate a plurality of sub-bands;

a code block generating step of splitting each sub-band to generate a plurality of code blocks each being of a predetermined size;

a bitplane generating step of generating a plurality of bitplanes from the most significant bit to the least significant bit, from one code block to another;

a bit modeling step of executing bit modeling from one bitplane to another;

an encoding pass generating step of generating an encoding pass from one bitplane to another;

an arithmetic encoding step of executing arithmetic coding in the encoding pass generated by said encoding pass generating step to generate an encoded

codestream;

- a splitting step of splitting said encoded codestream into a plurality of layers;
- a packet generating step of generating a plurality of packets from one layer to another;
- an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of one or more layers; and
- an embedding step of embedding an inspection symbol generated by said error correction encoding step in a portion of a predetermined code block or in a newly added encoding pass.

13. A picture decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in a packet of a predetermined lower layer, said apparatus comprising:

- analysis means for analyzing said input encoded codestream;
- extraction means for extracting said inspection symbol from a packet or packets of said lower layer;

error correcting decoding means for applying error correction and decoding to data of the header and/or a packet or packets of one or more preset layers, using said inspection symbol; and

decoding means for decoding the encoded codestream following the error correction and decoding.

14. The picture decoding apparatus according to claim 13 wherein said predetermined lower layer at least includes the lowermost layer.

15. The picture decoding apparatus according to claim 13 wherein said input encoded codestream has data of a packet or packets of said predetermined lower layer replaced by said inspection symbol; and

wherein said extraction means extracts said inspection symbol from a packet or packets of the lower layer, and discards the data of a packet or packets of the lower layer, or sets the data of a packet or packets of the lower layer all to zero.

16. A picture decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol, generated on this error correction coding, in a COM marker of a main header or a tile part header,

said apparatus comprising:

analysis means for analyzing said input encoded codestream;

extraction means for extracting said inspection symbol from said COM marker;

error correcting decoding means for applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol; and

decoding means for decoding the encoded codestream following the error correction and decoding.

17. A picture decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture, said encoded codestream being such a one obtained on filtering the input picture in a picture encoding apparatus to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks each being of a predetermined size, generating a plurality of bitplanes from the most significant bit to the least significant bit, from one code block to another; performing bit modeling from one bitplane to another to generate a plurality of encoding passes, performing arithmetic coding in the generated encoding passes to generate an encoded codestream, splitting said encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction and encoding to data of a header and/or the packet or packets of preset one or more layers to generate an

inspection symbol, and on embedding the generated inspection symbol in a portion of the preset code block or in a newly added encoding pass, said picture decoding apparatus comprising:

analysis means for analyzing said input encoded codestream;

extraction means for extracting said inspection symbol from said portion of the preset code block or in said newly added encoding pass;

error correcting decoding means for applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol; and

decoding means for decoding the encoded codestream following the error correction and decoding.

18. A picture decoding method in which an input encoded codestream is supplied and the supplied encoded codestream is decoded to restore an input picture, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in a packet of a predetermined lower layer, said method comprising:

an analysis step of analyzing said input encoded codestream;

an extraction step of extracting said inspection symbol from the packet or packets of said lower layer;

an error correcting decoding step of applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol; and

a decoding step of decoding the encoded codestream following the error correction and decoding.

19. A picture decoding method in which an input encoded codestream is supplied and the supplied encoded codestream is decoded to restore an input picture, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in a COM marker of a main header or a tile part header, said method comprising:

an analysis step of analyzing said input encoded codestream;

an extraction step of extracting said inspection symbol from said COM marker;

an error correcting decoding step of applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using

said inspection symbol; and

a decoding step of decoding the encoded codestream following the error correction and decoding.

20. A picture decoding method in which an encoded codestream is supplied and the input encoded codestream is decoded to restore an input picture, said encoded codestream being such a one obtained on filtering an input picture in a picture encoding apparatus to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks each being of a predetermined size, generating a plurality of bitplanes from the most significant bit to the least significant bit, from one of said code blocks to another, performing bit modeling from one bitplane to another to generate a plurality of encoding passes, performing arithmetic coding in the generated encoding passes to generate an encoded codestream, splitting said encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction and encoding to data of a header and/or a packet or packets of preset one or more layers, and on embedding the generated inspection symbol in a portion of the preset code block or in a newly added encoding pass; said picture decoding method comprising:

an analysis step of analyzing said input encoded codestream;

an extraction step of extracting said inspection symbol from said portion of the preset code block or in said newly added encoding pass;

an error correcting decoding step of applying error correction and decoding

to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol; and

a decoding step for decoding the encoded codestream following the error correction and decoding.

21. An error correction encoding apparatus comprising:

splitting means for being supplied with an encoded codestream, generated on arithmetic coding of an input picture, and for splitting the supplied encoded codestream into a plurality of layers;

packet generating means for generating a plurality of packets from one layer to another;

error correction encoding means for applying error correction encoding to data of a header and/or a packet of a predetermined one or more layers; and

embedding means for embedding an inspection symbol generated by said error correction encoding means in the packet of a predetermined lower layer.

22. The error correction encoding apparatus according to claim 21 wherein said predetermined one or more layers includes at least the uppermost layer.

23. The error correction encoding apparatus according to claim 21 wherein said embedding means substitutes said inspection symbol for data of the packet or packets of said predetermined lower layer.

24. The error correction encoding apparatus according to claim 23 wherein, if the data volume of said inspection symbol is larger than the data volume of the

packets of said predetermined lower layer, said embedding means embeds said inspection symbol across the packets of a plurality of lower layers including said predetermined lower layer.

25. The error correction encoding apparatus according to claim 21 wherein said embedding means appends said inspection symbol to data of the packet or packets of said predetermined lower layer.

26. The error correction encoding apparatus according to claim 25 wherein said embedding means changes the data length stated in a packet header of the packet or packets of said predetermined lower layer.

27. The error correction encoding apparatus according to claim 21 wherein said error correction encoding means sets the subject entity of the error correction encoding depending on the error rate of a communication channel on which said encoded codestream is transmitted.

28. An error correction encoding apparatus comprising:
splitting means for being supplied with an encoded codestream, generated on arithmetic coding of an input picture, and for splitting the supplied encoded codestream into a plurality of layers;

packet generating means for generating a plurality of packets from one layer to another;

error correction encoding means for applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers;

and

embedding means for embedding an inspection symbol generated by said error correction encoding means in a COM marker of a main header or a tile part header.

29. An error correction encoding apparatus comprising:

splitting means for splitting an encoded codestream into a plurality of layers, said encoded codestream being such a one obtained on applying filtering to an input picture in a picture encoding apparatus to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks each being of a predetermined size, generating a plurality of bitplanes from the most significant bit to the least significant bit, from one of said code blocks to another, bit modeling from one bitplane to another to generate a plurality of encoding passes; and performing arithmetic coding in the generated encoding passes;

packet generating means for generating a plurality of packets from one layer to another;

error correction encoding means for applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and

embedding means for embedding an inspection symbol generated by said error correction encoding means in a portion of a predetermined code block or in a newly added encoding pass.

30. An error correction encoding method comprising:

a splitting step of being supplied with an encoded codestream, generated on arithmetic coding of an input picture, and splitting the supplied encoded codestream into a plurality of layers;

a packet generating step of generating a plurality of packets from one layer to another;

an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and

an embedding step of embedding an inspection symbol generated by said error correction encoding step in the packet of a predetermined lower layer.

31. An error correction encoding method comprising:

a splitting step of being supplied with an encoded codestream, generated on arithmetic coding of an input picture, and splitting the supplied encoded codestream into a plurality of layers;

a packet generating step of generating a plurality of packets from one layer to another;

an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and

an embedding step of embedding an inspection symbol generated by said

error correction encoding step in a COM marker of a main header or a tile part header.

32. An error correction encoding method comprising:

a splitting step of splitting said encoded codestream into a plurality of layers, said encoded codestream being such a one obtained on filtering an input picture to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks each being of a predetermined size, generating a plurality of bitplanes from the most significant bit to the least significant bit, from one code block to another; performing bit modeling from one bitplane to another to generate a plurality of encoding passes, and performing arithmetic coding in the generated encoding passes;

a packet generating step of generating a plurality of packets from one layer to another;

an error correction encoding step of applying error correction encoding to data of a header and/or a packet or packets of a predetermined one or more layers; and

an embedding step of embedding an inspection symbol generated by said error correction encoding step in a portion of a predetermined code block or in a newly added encoding pass.

33. An error correction decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture,

said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in packets of a predetermined lower layer, said apparatus comprising:

an analysis means for analyzing said input encoded codestream;

an extraction means for extracting said inspection symbol from the packets of said lower layer; and

an error correcting decoding means for applying error correction and decoding to data of a header and/or the packets of one or more preset layers, using said inspection symbol.

34. The error correction decoding apparatus according to claim 33 wherein said predetermined one or more layers at least includes the uppermost layer.

35. The error correction decoding apparatus according to claim 33 wherein said input encoded codestream has data of the packets of said predetermined lower layer replaced by said inspection symbol; and

wherein said extraction means extracts said inspection symbol from the packets of the lower layer, and discards the data of the packet of the lower layer, or sets the data of the packets of the lower layer all to zero.

36. An error correction decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture, said encoded codestream being such a one obtained in a picture encoding apparatus on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in a COM marker of a main header or a tile part header, said apparatus comprising:

analysis means for analyzing said input encoded codestream;

extraction means for extracting said inspection symbol from the packet of said COM marker; and

error correcting decoding means for applying error correction and decoding to data of a header and/or a packet of one or more preset layers, using said inspection symbol.

37. An error correction decoding apparatus supplied with an encoded codestream and decoding the input encoded codestream to restore an input picture, said encoded codestream being such a one obtained on filtering an input picture in a picture encoding apparatus to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks, each being of a predetermined size, generating a plurality of bitplanes, from the most significant bit

to the least significant bit, from one code block to another, performing bit modeling from one bitplane to another to generate a plurality of encoding passes, performing arithmetic coding in the generated encoding pass to generate an encoded codestream, splitting said encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction and encoding to data of a header and/or the packets of a preset one or more layers, and on embedding the generated inspection symbol in a portion of the preset code block or in a newly added encoding pass; said apparatus comprising:

analysis means for analyzing said input encoded codestream;

extraction means for extracting said inspection symbol from said portion of the preset code block or from said newly added encoding pass; and

error correcting decoding means for applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol.

38. An error correction decoding method in which an encoded codestream is supplied and the input encoded codestream is decoded to restore an input picture, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection

symbol generated on this error correction coding in a packet of a predetermined lower layer, said method comprising:

- an analysis step of analyzing said input encoded codestream;
- an extraction step of extracting said inspection symbol from the packet of said lower layer; and
- an error correcting decoding step of applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using said inspection symbol.

39. An error correction decoding method in which an encoded codestream is supplied and the input encoded codestream is corrected for errors, said encoded codestream being such a one obtained on applying arithmetic coding to the input picture to generate an encoded codestream, splitting the encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction coding to data of a header and/or a packet or packets of one or more preset layers, and on embedding an inspection symbol generated on this error correction coding in a COM marker of a main header or a tile part header, said method comprising:

- an analysis step of analyzing said input encoded codestream;
- an extraction step of extracting said inspection symbol from the packet of said lower layer; and
- an error correcting decoding step of applying error correction and decoding

to data of a header and/or a packet of one or more preset layers, using said inspection symbol.

40. An error correction decoding method in which an encoded codestream is supplied and the input encoded codestream is corrected for errors, said encoded codestream being such a one obtained on filtering an input picture in a picture encoding apparatus to generate a plurality of sub-bands, splitting the generated sub-bands to generate a plurality of code blocks, each being of a predetermined size, generating a plurality of bitplanes, from the most significant bit to the least significant bit, from one code block to another; performing bit modeling from one bitplane to another to generate a plurality of coding passes, performing arithmetic coding in the generated encoding passes to generate an encoded codestream, splitting said encoded codestream into a plurality of layers, generating a plurality of packets from one layer to another, applying error correction and encoding to data of a header and/or a packet or packets of preset one or more layers, and on embedding the generated inspection symbol in a portion of the preset code block or in a newly added encoding pass; said method comprising:

an analysis step of analyzing said input encoded codestream;

an extraction step of extracting said inspection symbol from said portion of the preset code block or in said newly added encoding pass; and

an error correcting decoding step of applying error correction and decoding to data of a header and/or a packet or packets of one or more preset layers, using

said inspection symbol.